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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/960,398      | 09/24/2001  | Masaki Kurasawa      | 011254              | 5650             |

38834 7590 07/30/2004

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| EXAMINER |
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LE, THAO X

|          |              |
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| ART UNIT | PAPER NUMBER |
|----------|--------------|

2814

DATE MAILED: 07/30/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                               |                                 |  |
|------------------------------|-------------------------------|---------------------------------|--|
| <b>Office Action Summary</b> | Application No.<br>09/960,398 | Applicant(s)<br>KURASAWA ET AL. |  |
|                              | Examiner<br>Thao X Le         | Art Unit<br>2814                |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 28 May 2004.
- 2a) ☐ This action is **FINAL**.      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 11-14, 30 and 31 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1, 2, 5, 6, 9, 10, 13, 30 and 31 is/are allowed.
- 6) ☒ Claim(s) 3, 4, 7, 8, 11, 12 and 14 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |                                                                                                                        |                                                                                         |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                            | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____                                                |

### DETAILED ACTION

1. Claims 29 and 32 are canceled in the amendment dated 03 May 2004.

#### *Claim Rejections - 35 USC § 103*

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 3-4, 7-8, 11-12 are rejected under 35 U.S.C. 103(a) as being obvious over US 6573553 to Nakamura in view of JP 02000286396 to Hiyama et al.

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the

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inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). For applications filed on or after November 29, 1999, this rejection might also be overcome by showing that the subject matter of the reference and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person. See MPEP § 706.02(l)(1) and § 706.02(l)(2).

Regarding claim 3, Nakamura discloses a capacitor in fig. 4B comprising: a barrier metal layer 28, column 15 line 5, a lower electrode 29, column 14 line 65, formed on the barrier metal layer 28 and having a width larger than that of the barrier metal layer 28, a capacitor dielectric film 32, column 15 line 20 and column 28 lines 65-68, formed on the lower electrode 29, and formed of a perovskite ferroelectric material having a larger thermal expansion coefficient (CTE) than that of the substrate, and an upper electrode 33, column 27 line 19, formed on the capacitor dielectric film 32, the lower electrode 29 having a height larger than a width thereof.

But Nakamura does not expressly disclose the perovskite ferroelectric material 32 having a crystal oriented substantially perpendicular to a surface of the lower electrode

However, Hiyama reference discloses a capacitor comprising: a buffer structure 3 formed on a substrate 1, a lower electrode 4 formed on the buffer structure 3, a capacitor

dielectric film 5 formed on the lower electrode 4, and formed of a perovskite ferroelectric material (PZT), having a crystal oriented substantially perpendicular to a surface of the lower electrode 4. At the time the invention was made; it would have been obvious to one of ordinary skill in the art to use the PZT crystal orientation teaching of Hiyama in place of Nakamura's device, because it would have provided a FeRAM can be driven by the low battery as taught by Hiyama, see attachment [001].

With respect to the perovskite ferroelectric material having a larger thermal expansion coefficient (CTE) than that of the substrate, it is known that perovskite ferroelectric has the CTE (about  $3 \times 10^{-6}/\text{C}^\circ$ ) larger than that of silicon material (CTE about  $1 \times 10^{-6}/\text{C}^\circ$ ).

With respect to suppress stress applied to the capacitor dielectric film caused by a CTE difference between the substrate and the capacitor dielectric. This function is obvious in the structure because the when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be either anticipation or obviousness. *In re Best*, 195 USPQ 430, 433 (CCPA 1977).

Regarding claim 4, Nakamura discloses the Ru lower electrode 29 and ferroelectric capacitor dielectric 32; therefore the CTE of Ru metal would be larger than that of the PZT.

Regarding claims 7, 11-12, Nakamura does not disclose the capacitor wherein the capacitor dielectric film 32 has (001) oriented tetragonal and (111) oriented rhombohedral crystal structure.

However, Hiyama reference discloses the capacitor wherein the capacitor dielectric film 14 has (001) oriented tetragonal and (111) oriented rhombohedral crystal

structure and the lower electrode 4 has (100) and (111) cubic oriented crystal structure, see abstract. At the time the invention was made; it would have been obvious to one of ordinary skill in the art to use the PZT crystal orientation teaching of Hiyama in place of Nakamura's device, because it would have provided a FeRAM can be driven by the low battery as taught by Hiyama, see attachment [001].

Regarding to claims 14, Nakamura discloses a semiconductor device comprising: a memory cell transistor formed on a semiconductor substrate 11, column 14 line 5, and including a gate electrode 13, column 14 line 6, and source/drain diffused layers 17/18, column 14 line 26, formed in the semiconductor substrate 11 respectively on both sides of the gate electrode, fig. 2A, an insulation film 19/24, column 13 line 52, covering the semiconductor substrate with the memory cell transistor formed on; a contact plug 25, column 14 line 44, buried in the insulation film 19/24 and electrically connected to one of the source/drain diffused layers 17/18, a barrier metal layer 28, column 15 line 5, a lower electrode 29, column 14 line 65, formed on the barrier metal layer 28 and having a width larger than that of the barrier metal layer 28, a capacitor dielectric film 32, column 15 line 20 and column 28 lines 65-68, formed on the lower electrode 29, and formed of a perovskite ferroelectric material having a larger thermal expansion coefficient (CTE) than that of the substrate, and an upper electrode 33, column 27 line 19, formed on the capacitor dielectric film 32, the lower electrode 29 having a height larger than a width thereof.

But Nakamura does not expressly disclose the perovskite ferroelectric material 32 having a crystal oriented substantially perpendicular to a surface of the lower electrode

However, Hiyama reference discloses a capacitor comprising: a buffer structure 3 formed on a substrate 1, a lower electrode 4 formed on the buffer structure 3, a capacitor dielectric film 5 formed on the lower electrode 4, and formed of a perovskite ferroelectric material (PZT), having a crystal oriented substantially perpendicular to a surface of the lower electrode 4. At the time the invention was made; it would have been obvious to one of ordinary skill in the art to use the PZT crystal orientation teaching of Hiyama in place of Nakamura's device, because it would have provided a FeRAM can be driven by the low battery as taught by Hiyama, see attachment [001].

With respect to the perovskite ferroelectric material having a larger thermal expansion coefficient (CTE) than that of the substrate, it is known that perovskite ferroelectric has the CTE (about  $3 \times 10^{-6}/\text{C}^{\circ}$ ) larger than that of silicon material (CTE about  $1 \times 10^{-6}/\text{C}^{\circ}$ ).

With respect to suppress stress applied to the capacitor dielectric film caused by a CTE difference between the substrate and the capacitor dielectric. This function is obvious in the structure because the when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be either anticipation or obviousness. *In re Best*, 195 USPQ 430, 433 (CCPA 1977).

#### ***Allowable Subject Matter***

4. Claims 1-2, 5-6, 9-10, 13, and 30-31 are allowed because the prior art of record neither anticipated nor rendered obvious all the limitations of the base claim 1 and 13 including the buffer layer structure is formed of an insulating material.

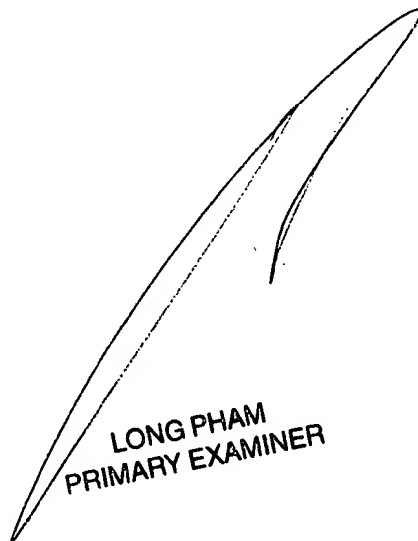
***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thao X Le whose telephone number is (571) 272-1708. The examiner can normally be reached on M-F from 8:00 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael M Fahmy can be reached on (571) 272 -1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Thao X. Le  
07 July 2004



LONG PHAM  
PRIMARY EXAMINER